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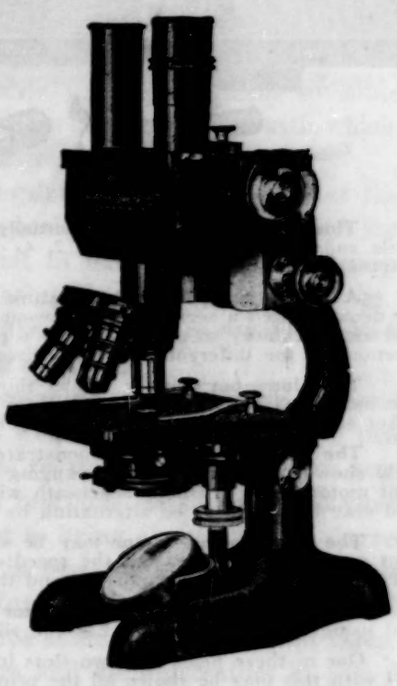

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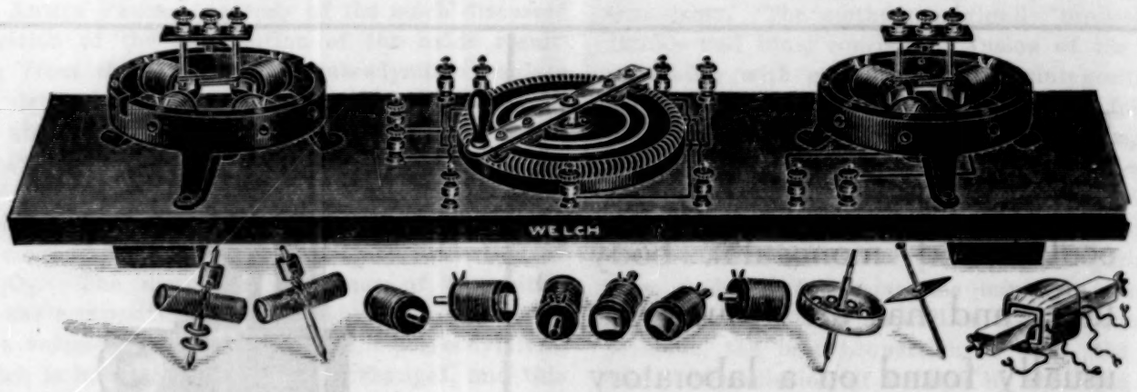

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PROBLEMS IN THE FIELD OF ANIMAL NUTRITION[1]

PROGRESS in the profession of animal production is obviously determined by our understanding of the facts and principles upon which it is based.

Having proceeded along lines of least resistance, for a certain time, limits to advancement are reached such that continued progress depends upon the solution of certain commanding or "key" problems. In the service of the profession, and of the nation, the sub-committee on animal nutrition of the National Research Council wishes to call attention to some of these more important problems, with which we are in immediate contact.

In so doing it is our hope that the problems will appeal to research workers in such ways as to result in extensive informal cooperation in their solution, simply through the choice of specific subjects for research within the general field as outlined.

However desirable is close cooperation in research work there may be great practical difficulties in providing for and in accomplishing such a relation. It seems practicable, however, at least to bring about a useful degree of correlation in research by inviting the choice of subjects for study from large projects having importance sufficient to commend them to experimentors and administrators in this field of endeavor.

We would indicate, therefore, the following problems and fields of research as worthy, in our opinion, of extensive and thoroughgoing study:

I. A general program of research on foods of animal origin in relation to human nutrition and to agriculture.

II. Growth curves of farm animals.

III. The establishment of a scientific basis for judging farm animals.

[1] By the sub-committee on animal nutrition, National Research Council.

IV. The estimation of metabolic nitrogen as a contribution to the perfection of feeding standards.

V. Mineral requirements of farm animals.

VI. Vitamin requirements of farm animals.

VII. Diet and reproduction.

I. A GENERAL PROGRAM OF RESEARCH ON ANIMAL FOODS IN RELATION TO HUMAN NUTRITION AND TO AGRICULTURE

Viewed in the largest and most general way, the human diet must contain a large proportion of cereal foods—for economic reasons.

Cereal products, however, are far from complete foods. Consider, for instance, white flour and refined sugar—perfect foods of their sort, and permanently established in the diet. In themselves they are in no way harmful; in many ways and for many purposes they are unexcelled; but these and other cereal products are among the most deficient of foods in a number of essential nutrients. In fact one of the most important dietary problems confronting civilized man to-day is that of restoring the balance of essential nutrients which has been disturbed by the prevailing use of cereal products.

Since human beings will always consume large amounts of cereal foods, a factor of surpassing importance is that portion of the diet which supplies the essential nutrients in which they (the cereal foods) are deficient.

The classes of foods best qualified to supply these deficiencies are especially the animal foods, meats, milk and eggs, but also fruits, nuts and vegetables.

The costs of production of foods of vegetable origin, in terms of land and labor, may be grouped together, as of similar magnitude.

The costs of production of the highly desirable foods of animal origin are very much greater; so that, in times of economic stress, and as increase of population gradually overtakes the possible food supply, the terms upon which animal foods may be had becomes a matter of very great and of increasing importance.

While all animal foods are relatively expensive they differ much in land and labor costs, and also in nutritive values, dietetic uses and general economic significance, through relation not only to land and labor, but also to transportation, marketing, cropping systems and fertility of the soil.

The objects of this project are (1) to determine the proper place of animal foods, as a group, in the human diet; (2) to establish the facts as to the specific nutritive and dietetic functions of meat, milk and eggs; and (3) to show the position and relationships of the several types of animal food production in the national system of agriculture.

With these points in mind we propose the following outline for an extensive program of researches on food of animal origin.

OUTLINE OF RESEARCH

(1) Human nutrition:

a. The place of animal foods in the diet, in infancy, childhood, maturity, reproduction, senescence, sickness, labor, war and sedentary life; limits of dietetic interchangeability of animal foods.

This group of problems in practical human dietetics has always been, and always will be. We have reached an age, however, in which progress in their solution is possible at rates vastly greater than in any earlier era; and these great problems must be kept constantly before research men in order that no opportunity may be overlooked for contributing to their solution through the undertaking of definite projects of properly limited scope.

The necessary backgrounds for such researches, in the way of laboratories, groups of competent investigators, and institutions of various sorts providing satisfactory groups of experimental subjects, are not uncommon; but men who are able and interested to organize and to conduct such investigations, and who can command the necessary human cooperation, are rare. The more honor then to him who succeeds in this most important field of service.

b. Nutritive values of animal foods as supplementary to other components of mixed diets.

The superiority of animal foods, for supplementary purposes, varies much with the natural food-habit of the kind of animal under observation. It is especially prominent with poultry. It is not so with herbivora. The desirability of experimenting with human beings directly, before drawing final conclusions, is obvious.

c. Nutritive values of constituent compounds,

especially the proteins, of foods of animal origin.

The investigation of this group of problems, in the laboratory, with small animals as subjects, will throw much light, by inference, upon problems of human nutrition, and will afford valuable guidance in the planning of experiments with human beings as subjects.

d. Healthfulness of animal foods, as affected by contamination and infection.

More definite information is needed as to the viability of the pathogenic organisms which may be carried by foods of animal origin, as affected by the various methods of preparation and use.

e. Composition of animal foods—amino acids, non-amino nitrogen, fats, phosphatids, inorganic compounds, vitamins; methods of separation and purification of constituent compounds.

Immediate interest would attach to further determinations of the presence of vitamins in various meats and to the iron contents of the same.

(2) Agriculture:

The ever-increasing congestion of population upon the earth renders increasingly important the realization by every man of the nature of his dependence upon agriculture, and of the nature of the complicated agricultural situation upon which he depends.

A series of researches on the subjects here suggested, and the promulgation of the facts derived and assembled, must have a most salutary effect, not only as a stabilizing influence with the man in the street, but particularly through broadening the understanding of some of the leaders among men, who are "educated beyond their information."

This outline is intended to call attention to the fundamental and essential relations of one kind of animal food production to another, and of animal food production, in general, to agriculture.

a. Physiological economy of production of animal foods, considering the entire life of the animal and the entire business of production.

b. Relative draft upon or contribution to soil fertility of various systems of animal food production.

c. Relative proportions of feeds used in various systems of animal food production which are usable by human beings.

d. The utilization of manufactory by-products, farm wastes and unmarketable forage in various systems of animal food production.

e. Systems of animal food production as means of saving cost of transportation of feed.

f. Relative costs of transportation and marketing of various animal foods.

g. Production per acre of land, in various systems of animal food production.

h. Relative labor requirements of various systems of animal food production.

i. Relation of systems of animal food production to cropping systems.

II. THE GROWTH CURVES OF FARM ANIMALS

Throughout our research work in the feeding of animals the results would gain much in value and significance if it were possible to compare them with normal standards.

The development of the vitamin hypothesis, and of the modern doctrine of protein metabolism have been greatly facilitated by the establishment of normal standards, in the shape of growth curves, for the experimental animals used.

Similar normal curves of growth should be determined for all breeds and types of animals of economic value.

These will be of especial service as means of comparison in making graphic representation of the results of studies of breeds, individuality, rations and supplements, in relation to growth, lactation or other performance.

III. THE ESTABLISHMENT OF A SCIENTIFIC BASIS FOR JUDGING FARM ANIMALS

Our present standards of livestock selection rest upon the cumulative experience of many centuries of livestock breeding, the practical judgments of the markets for animal products, and the conventional specifications of the breed associations.

To only a slight extent do these standards rest at present upon results of systematic and orderly studies by the methods of science.

In our opinion the subject of livestock judging is of such practical value and has such appeal to the interest of the student that it can not be spared from the college curriculum; but it is also our opinion that it can not continue indefinitely to hold its own on the present basis.

A scientific foundation should be established

for livestock judging, based upon a critical study of the entire subject from the standpoints of the anatomy and physiology of the animal, and also upon the determination of the correlations existing between the measurable proportions and functions of animals, by the methods of biometric research.

The following specific problems for investigation are suggested as illustrating the point of view expressed:

1. A study of factors which influence the apparent spring of ribs.
2. Conditions of the eyes of animals, and what they indicate.
3. Qualities of hair and hide of animals, and what they indicate.
4. Indications of conditions as to texture of flesh of meat animals.
5. Indications of conditions as to density of skeletal structure.
6. The development of heart and lungs as compared with the development of the alimentary tract, in relation to constitutional vigor and to capacity for early maturity.
7. Indications of relative development of muscle, fat and bone.
8. Breadth of chest—what determines it and what it signifies.
9. Relation of heart-girth to development of lungs.
10. Proportions of the skull and what they indicate.
11. Conditions of development of the vertebral column and what they indicate.
12. The anatomy, histology and physiology of the unsoundnesses of horses.
13. Conditions as to development and position of mammary veins and what they signify.

IV. THE ESTIMATION OF METABOLIC NITROGEN

As a temporary expedient, pending the completion of more nearly perfect feeding standards—a very important improvement of the Modified Wolff-Lehmann standards would result from reducing them to a basis of "refined digestible nutrients"—truly digestible crude protein (corrected for metabolic nitrogen) and truly digestible non-nitrogenous nutriment (corrected for fermentation losses in methane and carbon dioxide).

One of the prerequisites of this improvement is the determination of the amount of metabolic nitrogen in the feces. There is no known method for estimating metabolic nitrogen with anything approaching scientific accuracy, but we suggest a method of approach to this problem which seems to us worthy of consideration.

Choose several proteins, which, presumably, are completely digestible. In nitrogen balance experiments add each of these proteins, in graduated amounts, in a series of experimental periods, to otherwise nitrogen-free basal rations. That kind of protein which, when thus varied in amount, does not cause the total feces nitrogen to vary, we would rate as *completely digestible;* and the total feces nitrogen in these periods would be considered as of metabolic origin.

Having thus determined the amount of the metabolic nitrogen, then determine, by further experimentation, the relation of the metabolic nitrogen outgo to the live weight, or to the surface area of the animal, or to whatever other readily determinable factor it may be found to vary with, thus making possible the computation, by difference, of the indigestible and the truly digestible protein.

It is believed that this will give more nearly true figures for metabolic nitrogen than will those representing the total nitrogen of the feces from a nitrogen-free ration, since the presence of a normal proportion of protein in the ration will be conducive to the growth of a normal bacterial flora in the alimentary tract, these bacteria, presumably, contributing an important fraction to the indigestible protein of the feces.

V. MINERAL REQUIREMENTS OF FARM ANIMALS

An important problem in this field is to determine, by carefully controlled, long-time feeding experiments with dairy cattle, under conditions of practice, the effect of differences of intake of mineral nutrients, especially as contained in leguminous as compared with gramineous roughage, and in mineral supplements, on growth and productive efficiency.

In order to obtain reliable determinations of final effects the observations should be carried through the entire period of growth and production, with a considerable number of individuals.

VI. VITAMIN REQUIREMENTS OF FARM ANIMALS

The knowledge of the vitamins should be ex-

tended as far as possible into the field of animal production.

Poultry furnish excellent material for vitamin studies; swine are also conveniently usable; and there is some evidence that a vitamin in forage is intimately related to the utilization of mineral nutrients by ruminants.

The effects of feeds, and of methods of production of feeds, on the vitamin content of the milk and the tissues and organs of animals should also be investigated.

VII. DIET AND REPRODUCTION

Evidence is gradually accumulating which suggests that diet is a factor of greater importance than has been understood in relation to reproduction in farm animals. While it appears that mineral nutrients and vitamins may contribute to the specific effects of feeds, in this relation, we do not have evidence to indicate that these effects are due to these two factors alone.

Poultry, swine and cattle are conveniently usable for the investigation of this problem, and there are indications that the general system of farming, as determining the feeds available, contributes in important ways to efficiency of reproduction in livestock. So important a situation must challenge the researcher in the field of animal production.

IN CONCLUSION

The members of this sub-committee, individually, and the sub-committee, as such, have given especial attention to methods of experimentation in animal nutrition. The sub-committee offers its cooperation to any who may desire it, in the making of detailed plans for investigations in any of the fields suggested.

SUB-COMMITTEE ON ANIMAL NUTRITION.

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THE CONFIRMATION OF THE EINSTEIN PREDICTION[1]

IN the year 1916 Professor Einstein extended his theory of relativity to include gravitation. Einstein expresses the law of gravitation in a form very different from Newton's inverse square of the distance. But in nearly all applications to the movements of the heavenly bodies the two laws give identical results. Had it not been so, the new theory could not have been right, for Newton's law is able to predict the movements of the sun, moon and planets with the utmost precision. But Einstein pointed out three refined observations in which his law differed from Newton's. The first of these is a small rotation of the orbit of the planet Mercury, discovered by Leverrier and, in spite of many attempts, was not satisfactorily explained. Einstein's law agreed with the observations and accounted for a small divergence from Newton's law. This remarkable achievement aroused the interest of astronomers in the new theory.

Einstein pointed out that not only matter, but also light was subject to gravitation. A ray of light which in its journey to the earth passes near the sun will have its path appreciably bent. If a photograph could be taken showing the stars surrounding the sun, these would be in slightly different relative positions from those they occupy in a photograph taken when the sun is in another part of the sky. Owing to the great light of the sun such a photograph can only be taken during a total solar eclipse. It was pointed out by Einstein that with Newton's law also the light passing near the sun would be deflected, but only to half the extent predicted by the generalized theory of relativity.

Two British expeditions went out in 1919 to observe the eclipse of May, Professor Eddington and Mr. Cottingham to Principe on the West Coast of Africa, and Dr. Crommelin and Mr. Davidson from Greenwich to North Brazil. There were three possibilities. Would the light be deflected at all, or by the amount Einstein's law required, or by half this amount? The observations are not easy, because the quantity to be observed is very small. A star on the photographic plate is a small dot, and the displacements to be expected only amounted to

[1] From the London *Times*.

quantities ranging from one third to one tenth of the diameter of one of these small dots. The observers in Brazil had extremely good weather and the expedition was a brilliant success. The observers felt that there was no ambiguity about the result. Einstein's prediction was verified. The observers in Africa were not fortunate in the weather, but obtained photographs showing a few stars, and they confirmed the results found in Brazil.

An account of the expedition was given to the Royal Society in November, 1919, and copies of some of the photographs taken in Brazil were circulated to representative astronomers. Generally speaking, those astronomers who were used to refined stellar photography agreed that the British astronomers had verified Einstein's prediction beyond any reasonable doubt. A certain number remained unconvinced and it was generally considered that in a matter of such great scientific importance further verification was desirable. Accordingly arrangements were made for the observation of the total solar eclipse of September, 1922. The British expedition to Christmas Island, Mr. Jones and Mr. Melotte from Greenwich, had the disappointing experience of a cloudy day. The American and Australian parties had better fortune. The photographs taken by the Australian astronomers have not yet been measured. The results of the Canadian party were recently received in this country from Professor Chant of Toronto and as far as they go confirm Einstein's law.

The best equipped of the parties was that from the Lick Observatory, consisting of Professor Campbell, Professor Trumpler and a number of other astronomers, who occupied a somewhat inaccessible spot on the northwest coast of Australia. Happily, the enthusiasm, time, labor and money devoted to this expedition have been rewarded. I received a cable message yesterday from Professor Campbell saying that they had completed the comparison of three photographs taken during the eclipse with three which had been previously taken of the same part of the sky. They find for the amount of displacement of a ray of light which would just graze the sun values from 1.86 seconds of arc to 1.59 with a mean value 1.74 seconds, agreeing exactly with Einstein's prediction.

The astronomers of the Lick Observatory are convinced that Einstein's law has been verified sufficiently and propose to devote themselves to other problems at the next eclipse. It is very satisfactory to have a complete agreement on the second of Einstein's crucial tests. It can hardly be doubted that Einstein's law of gravitation is correct, whatever difficulties may be found with other parts of his theory of relativity.

FRANK DYSON
ASTRONOMER ROYAL

The confirmation by President Campbell (for in addition to remaining the Director of the Lick Observatory he is now president of California University, to which the observatory is attached) of the Einstein prediction may be fairly said to settle this important matter. This does not, however, mean that our English observers, who obtained a similar result four years ago, had themselves any lingering doubts, but they knew that in any kind of scientific work it is only too easy to arrive at conflicting results, and when this situation arises the experiments or observations must be continued and varied until the source of conflict is detected and removed, so that all the final results are accordant.

For laboratory experiments such repetition involves little more than industry, for the opportunities are unrestricted; but when the only opportunity for making a test happens to be the rare occasion of a total eclipse of the sun the matter assumes a very different aspect. Each experiment involves a costly expedition to some distant part of the world for which funds may be hard to find; it also may involve discomfort and may end in disappointment. The American observers camped for a month in an unattractive part of the Australian desert, but were fortunate in their weather; our English observers spent six months on Christmas Island, only to have a cloudy day at the last. In addition to such drawbacks it was known that each successive eclipse was, for years to come, a less favorable opportunity for making the Einstein test than the one before.

The best of all was that of 1919, and to the Astronomer Royal belongs the credit of drawing attention to its specially favorable character during the blackest time of the war, when the prospects of utilizing it seemed very remote. Fortunately this dismal outlook did not prevent preparations from being made which enabled the English observers to take full advantage of the opportunity which the Armistice enabled them to grasp, with the well-known result which startled the world.

It was, however, such an amazing surprise that demand for confirmation was in every way reasonable and accordingly parties from Australia, Canada, England, Germany and the United States all prepared to observe the eclipse of last year. There were undoubtedly those who thought the English observers had made a mistake in 1919 and who wished to test the matter for themselves. I think it may not unfairly be said that President Campbell was on the skeptical side, which makes his present testimony the more valuable. Had conflicting results been obtained there would be no alternative but to go on repeating the tests. There is an eclipse this autumn visible in the United States, for which some preparations have already been made, though probably they will now be abandoned. But each successive opportunity, as already stated, offered less than the one before: 1922 was not so good as 1919; 1923 not so good as 1922; others in the future so far as they have been scrutinized less favorable still, so that the announcement of a discrepancy which must be tracked to its source with continually diminishing chances of tracking it would have been a little disheartening.

The telegram to the Astronomer Royal is thus doubly welcome: not only is there natural satisfaction at the accordance of entirely independent testimony on an important matter, but there is also relief from the threat of an arduous campaign, which even confidence in ultimate victory could not altogether compensate. The faces at the meeting of the Royal Astronomical Society yesterday were perceptibly brighter than usual.

H. H. TURNER

UNIVERSITY OBSERVATORY,
OXFORD

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SPRING MEETING OF THE EXECUTIVE COMMITTEE OF THE COUNCIL

THE regular spring meeting of the Executive Committee of the Council of the Association occurred at the Cosmos Club in Washington on April 22. The following members were present: J. McKeen Cattell, H. L. Fairchild, W. J. Humphreys, B. E. Livingston, D. T. MacDougal, Herbert Osborn, Charles D. Walcott, Henry B. Ward. Dr. Simon Flexner and Dr. A. A. Noyes were unable to attend. President Walcott was in the chair during the first part of the meeting, but was obliged to leave before all the business was completed. Dr. H. L. Fairchild took the chair after Doctor Walcott's departure. The following items of business were transacted:

1. The minutes of the last meeting of the Committee and the minutes of proceedings carried out by mail ballots in the interim since the last meeting had been previously circulated to the members and were accepted without being read.

2. The permanent secretary presented his semi-annual report, which will be summarized elsewhere in SCIENCE.

3. The general secretary reported that the committee on Photosynthesis, authorized at the Boston meeting, has been organized with the following members: D. T. MacDougal, chairman; S. E. Sheppard, secretary; W. G. Abbott; F. G. Cottrell; Moses Gomberg; W. J. Humphreys; E. E. Slosson; H. A. Spoehr. This committee hopes to act as a focus for bringing together ideas and suggestions that may lead to substantial progress in our knowledge of photosynthesis and it hopes to serve by facilitating cooperation among research workers in this field. (See SCIENCE for May 4, page 522.)

4. The general secretary reported that he had conferred with the secretary of the Pacific Division with regard to the preparations and plans for the approaching Los Angeles meeting and that the preliminary work for the meeting is progressing very satisfactorily. It was noted that the Los Angeles meeting will be of special interest on account of program features dealing with the solar eclipse that will have oc-

curred just preceding the meeting. Many noted astronomers will be present and will take part in the program.

5. It was voted that, because of the serious illness of Dr. R. S. Woodward, on account of which the executive committee expressed its deep concern, the permanent secretary is authorized to disburse from the funds of his office any payments that would ordinarily be made by the treasurer, it being understood that the permanent secretary's office is to be subsequently reimbursed for such disbursements.

6. The members of the section committee for Section N, nominated by the committee, were elected. The new members of the section committee are as follows: Joseph Leidy, Jr. (retiring at the end of the annual meeting of December, 1926), 1319 Locust Street, Philadelphia, Pennsylvania; R. G. Hoskins (retiring at the end of the annual meeting of December, 1925), 710 N. Park Street, Columbus, Ohio.

7. The executive committee confirmed the election of Dr. Louis T. More, of the University of Cincinnati, as chairman of the local committee for the third Cincinnati meeting and expressed its appreciation of the very satisfactory progress that has already been made by Dr. More and other Cincinnati members in preparing for the next annual meeting.

8. Dr. W. W. Campbell, director of the Lick Observatory and president-elect of the University of California, was nominated to Science Service as one of the trustees of Science Service from the A. A. A. S., to succeed Dr. George T. Moore, whose term has expired.

9. Forty-nine fellows were elected on regular nominations, these being distributed among the sections as follows: B, 2; D, 27; E, 1; F, 5; G, 6; M, 1; N, 3; O, 4. The executive committee instructed the permanent secretary to make arrangements for bringing fellowship elections in the association up to date as soon as may be, if possible before the seventy-fifth anniversary meeting at Cincinnati next December.

10. Dr. Fairchild presented to the Association a photograph taken at the Rochester meeting in August, 1892, and showing portraits of Joseph LeConte (then president of the association), F. W. Putnam (permanent secretary) and H. L. Fairchild (local secretary for the Rochester meeting). This photograph was accepted with thanks by the executive committee and the permanent secretary was instructed to preserve it with the collection of photographs now in his hands.

11. The executive committee considered briefly the relations between the A. A. A. S. and the Union of American Biological Societies and reaffirmed its desire to do everything feasible to further the work of the Union. The appointments of the following representatives of the Association in the council of the Union were confirmed:

Representing A. A. A. S. as a whole:
Burton E. Livingston;
Henry B. Ward.
Representing Section F:
Herbert Osborn.
Representing Section G:
C. O. Appleman.
Representing Section N:
C. A. Kofoid.
Representing Section O:
R. W. Thatcher.

12. It was voted that the committee of bibliography of science be continued. The resignation of the chairman (Dr. C. B. Davenport) was accepted. The executive committee expressed its gratification that the original work of Dr. Davenport and his committee has borne fruit in the present arrangements by which the Concilium Biblographicum is being continued and made still more efficient under the auspices of the National Research Council and the Rockefeller Foundation. Dr. B. E. Livingston was named as chairman of the Committee on Bibliography and the committee was asked to make still further recommendations for the continued improvement of bibliographic and abstracting service in the field of science.

13. The executive committee considered a communication from Dr. C. B. Davenport regarding the plans for the National Union List of Serials, now being undertaken by Mr. H. M. Lydenberg, reference librarian of the New York Public Library, and the H. W. Wilson Company. The committee regards the preparation of such a list as very important and feels that a list of this kind for scientific periodicals is very greatly needed and will greatly facilitate scientific research.

14. The attitude of the American Association with regard to the problem of Pueblo Indian

lands, expressed in principle by action of the council at the fourth Boston meeting, was reaffirmed and a resolution was adopted giving formal statement to that attitude. The resolution will appear in SCIENCE.

15. It was voted that the Association wishes to aid in every feasible way the constructive work of the American Engineering Standards Committee, in its efforts to secure standardization of mathematical and physical symbols and abbreviations. The question as to whether the association should become a formal sponsor for a joint committee on symbols and abbreviations was referred to the association's special committee on this subject, with the request that the last-named committee make recommendations to the executive committee. The special committee consists of the following members: Henry Norris Russell, chairman; Augustus Trowbridge; E. W. Washburn.

16. A report was received on the work accomplished by the special committee on the development of geological features in city parks and the executive committee approved of the plan adopted by the special committee. The committee consists of the following members: W. M. Davis, chairman; E. S. Moore; Charles D. Walcott. A circular letter will soon be sent by the special committee to every American geologist, asking them to further his project to increase the educational value of city parks by bringing geological features to the attention and understanding of the public. For each of a number of cities a prominent geologist will be asked to act as local chairman for this movement, to call a meeting of geologists and other interested persons, which may take the needed steps toward accomplishing the end in view. All members of the Association are asked to lend their aid.

17. The executive committee considered a communication from Dr. C. R. Scholl, president of the Historical Society of Berks County, Pennsylvania, describing plans for the erection of a tablet memorial to Spencer Fullerton Baird, to be erected in Reading, Pa., on the site of his birthplace and voted its hearty approval of these plans.

18. The executive committee approved the action of Section E, as expressed in a memorandum prepared by a special committee of Section E at the recent Boston meeting, urging the establishment of the office of state geologist in Massachusetts, or of a state geological survey.

19. A communication was read from Dr. E. W. Washburn, pointing out the need of financial support for the Annual Tables of data of physics, chemistry and technology, compiled under the auspices of the International Union of Pure and Applied Chemistry, of the International Research Council, and the executive committee instructed the permanent secretary to inquire of the committee on grants whether or not it might be possible to make a grant from the grants funds of the association toward the financial support of the Annual Tables. If such a grant is possible, it might be made with the idea of its being continued in future years. The committee voted that, if the committee on grants is not able this year to take action in support of this project, the permanent secretary is authorized to make from his current funds and for the present year only a contribution of not over $200 for the support of the Annual Tables.

20. Dr. W. J. Humphreys made a progress report for the special committee on science reviews, established at the recent Boston meeting. The report was accepted and the special committee was asked to continue its study of ways and means for inaugurating improved facilities for the preparation and publication of critical reviews of scientific books. The committee consists of the following members: W. J. Humphreys, chairman; J. McKeen Cattell; D. T. MacDougal; Raymond Pearl, Robert B. Sosman.

21. A progress report was accepted from the permanent secretary, regarding the project of securing the organization of the philological sciences in the American Association for the Advancement of Science. Professor W. A. Oldfather, professor of classics in the University of Illinois, has accepted the chairmanship of the special committee on the organization of philological sciences in the A. A. A. S., this committee having been authorized at the recent Boston meeting. Professor Mark H. Liddell, professor of English at Purdue University, is secretary of the special committee. A leaflet signed by seven leading American philologists

has been prepared and will soon be sent out to all who may be interested. A letter signed by the permanent secretary and Professor Liddell is to accompany the leaflet.

22. The Potato Association of America was elected to be an associated society of the American Association for the Advancement of Science.

23. The executive committee expressed its gratification with respect to the fact that Retiring President McMurrich will be able to represent the Association at the Liverpool meeting of the British Association for the Advancement of Science. It was recommended that two other representatives be appointed, this matter being left in the hands of the president.

24. The executive committee considered the difficulty encountered in securing good attendance at Council sessions after the first day of the Council meeting (on account of conflicts with section and society sessions). To avoid this difficulty as much as possible the permanent secretary was instructed to inform the members of the Council that the main session of the Council will occur on the afternoon of the first day of the annual meeting, calling attention to the fact that there will be few or no conflicts at that time and also to inform them that Council sessions on the following days will be called promptly at 9:00 and adjourned promptly at 9:45. The permanent secretary was also instructed to arrange for promptness in calling and adjourning the Council sessions.

25. The executive committee voted that it is desirable to hold at least one special joint session at the approaching Cincinnati meeting, to be devoted to the history of the association and of American science during the last seventy-five years. It was suggested that this might well be an evening session with a lecture on this subject to be given by some prominent man of science. Further details in this regard were left in the hands of a special committee, with power, consisting of J. McKeen Cattell, chairman, L. O. Howard, B. E. Livingston.

26. The executive committee expressed its gratification at the arrangement of the Society of Sigma Xi, by which Dr. W. R. Whitney, of the General Electric Company, is to give the second annual Sigma Xi lecture, under the joint auspices of the Society of Sigma Xi and the A. A. A. S., at the third Cincinnati meeting. This lecture is to be given on the evening of the second day of the meeting, Friday, December 28, 1923.

27. The possibility of securing more extended publicity for the annual meeting by the use of a gummed label or poster, by special printing on the envelopes used in correspondence during the autumn, or by other means, was considered briefly and the permanent secretary was instructed to study this matter and proceed according to his judgment. The permanent secretary will be glad to receive suggestions from the members in this connection.

28. On account of financial and other conditions in the South and with the approval of Dr. A. P. Bourland, secretary of the Southern Education Society, it was voted that affiliation of the Southern Education Society be discontinued.

29. The request from the treasurer of the Ohio Academy of Science that the Washington office collect all academy dues of academy members who are members of the American Association for the Advancement of Science was considered and the permanent secretary was instructed to carry out this suggestion for the Ohio Academy and also for the North Carolina Academy, for one year, and to report as to its feasibility.

BURTON E. LIVINGSTON
Permanent Secretary

SCIENTIFIC EVENTS

THE BRITISH METEOROLOGICAL OFFICE[1]

THE annual report of the Meteorological Committee to the Air Council for the year ended March 31, 1922, has recently been issued. It is the sixty-seventh year of the Meteorological Office and the second report submitted to the Air Council instead of to the Treasury as formerly. The meteorological service now comprises many meteorological organizations which in past years have been carried on separately and independently. In all, the total staff aimed at to complete the organization is 375. Retrenchments undertaken, however, by all government departments have led to some modified

[1] From *Nature*.

programs for the meteorological service and reductions in the staff have taken place instead of the wished-for augmentation. The total whole-time staff of the Meteorological Office and its out-stations has changed during the year from 266 to 261. The year has seen a great increase in the interest of seamen in weather information and the report mentions that it is greatly to be regretted that this increased interest should coincide with conditions which have made it imperative to reduce rather than to extend the activities of the Marine Division. Data now being received are gradually getting back to pre-war conditions, when it was equally felt that excessive observations were costly. For forecasting work the report states that, although certain messages are still received by cable, almost all European countries have now adopted the use of wireless telegraphy and it is growing evident that it will shortly be possible to dispense with exchange of messages by cable. Much information is given relative to aviation and the upper air, new developments entailing much organization. The British Rainfall Organization is now controlled by the Meteorological Office and among many other branches of work may be mentioned atmospheric pollution and the oversight of attached and subsidiary observatories.

THE "ZOOLOGICAL RECORD"

MR. P. CHALMERS MITCHELL, of the Zoological Society of London, writes to the London *Times* under date of April 21, as follows:

May I say that the council of the Zoological Society will much regret if the *Zoological Record*, which it has supported with increasing financial difficulty for many years, has to be dropped? But the annual loss on the issues is over £1,100, and is likely to increase as the output of zoological research increases.

Bibliographical work, although necessary for all branches of zoology, is of less immediate concern to a society whose primary function is the care and study of living animals than to museums, general laboratories, universities and the various institutions dealing with medical zoology, parasitology, economic entomology and so forth. Last year the council, in its annual report and in circulars addressed to zoologists and zoological institutions throughout the world, explained the financial position, and stated that unless those to whom the *Record* was "invaluable" showed their appreciation of it by subscribing for a sufficient number of copies, the society could no longer undertake the publication. The response was unsatisfactory, and the council has accordingly taken the inevitable step of making it known that the *Record* will be discontinued unless substantial help is forthcoming. But it is so anxious to give those to whom the *Record* is necessary full opportunity of coming to its support, that it has undertaken to proceed with the compilation so that no time may be lost.

I fear that the suggestion of your correspondent, Mr. Stanley Kemp, in to-day's issue is not helpful; because of the drain of the *Record* on our resources we have already been compelled to suspend the publication of our "Transactions," and to postpone other scientific work of immediate interest to us; we are certainly not going to suspend the issue of our "Scientific Proceedings," which have appeared continuously since 1829, in order to carry out bibliographical work for other institutions. On the other hand, we are ready to continue the *Record*, and to regard a loss of £500 a year as part of our contribution to the common good of zoological science, if other institutions guarantee us against further loss.

A NEW CHEMICAL LABORATORY FOR HARVARD UNIVERSITY

IMMEDIATE measures for raising funds for a new chemical laboratory at Harvard University are imperative, according to the report of a committee of graduates appointed by Langdon P. Marvin, '98, president of the Associated Harvard Clubs, to consider the needs of the department of chemistry.

Stating emphatically that the present physical dilapidation of Boylston Hall, the main Harvard chemical laboratory, is "almost beyond belief" and that thirty-three years ago it was already considered antiquated, the committee asserts that even if this building is extensively repaired, "the only result achieved will be a third-class laboratory that has accommodations for about one-half the number of students that will be forced to work in it. It would be utterly impossible to provide for normal growth by such means."

Every graduate who has a son going to Harvard should visit Boylston Hall and see where he will have to work [reports the committee]. What can be said for the professors who have to do the teaching? Simply that devotion to the university and their belief in its future has kept them at their posts. Every one of them could

step out into better positions. In theoretical chemistry the Harvard staff have no superiors in America to-day. It is manifestly difficult, however, to hold a faculty together when such sacrifices are demanded, and new professors from the outside are not attracted to Harvard, which is not a healthy condition for any faculty to be in. How long then must chemistry at Harvard be confined to the narrow, unsuitable, inadequate bounds that restrict and distort its growth?

The present inadequate provision for the study of chemistry is not a matter that concerns only the Division of Chemistry when so large a proportion as thirty-five to forty-five per cent. of the undergraduates is involved. The necessity of the occasion demands that every Harvard man and every friend of Harvard should at once become interested in this most vital need of the university. When the Associated Harvard Clubs and the alumni of Harvard really understand this deplorable and impossible condition of the Division of Chemistry, this committee believes that they will not rest until the situation is cured.

The committee of Harvard graduates which made the report is headed by Edward Mallinckrodt, Jr., of Saint Louis. The other members are Dr. William S. Thayer, of Baltimore; Professor Theodore W. Richards, of Cambridge; W. Cameron Forbes, of Westwood, Mass.; Martin H. Ittner, of Jersey City; Eugene DuPont, of Greenville, Del.; Eliot Wadsworth, of Washington; G. Cook Kimball, of Pittsburgh; Isaac P. Hazard, of Syracuse, and Elihu Thomson, of Swampscott, Mass.

CONFERENCE ON WEIGHTS AND MEASURES

THE sixteenth annual conference on weights and measures will be held at the Bureau of Standards on May 21 to 24 inclusive. Invitations have been sent out to all state, municipal and other officials who are interested in weights and measures matters and judging by the replies received the conference will be unusually well attended.

A tentative list of papers which will be presented has been prepared, the titles of some of which are as follows: "Fraudulent practices and how we eliminated them," "The attitude of the Mid-west toward abolition of bushel weights," "Temperature as a factor in the measurement of gasoline," "Cooperation between state and local officials," "Divergence in bread labeling requirements," "Bread weight regulation from the standpoint of the retail baker," "The organization and conduct of city and county departments of weights and measures," "Problems arising in the supervision of public markets," "Origin and destination weighing of coal in carload lots," "Retail sales of coal and coke," "A standard test method for milk bottles," "Results of the Bureau's investigation of the commercial filling of milk bottles," "Commodity tolerances" and "Sale of service by weight or measure."

Among the reports of committees will be one on bread legislation and another on specifications and tolerances for vehicle tanks and fabric measuring machines.

The first morning of the conference will be devoted to the reports of delegates, while the second day will be "City and County Day," its sessions being devoted entirely to the problems of city and county weights and measures officials.

In connection with the conference the usual exhibit of weighing and measuring appliances will be held in the Industrial Building of the Bureau and it is expected that a large number of firms will avail themselves of this opportunity to set before weights and measures officials the latest improvements in their products.

THE FIRST DECADE OF THE ROCKEFELLER FOUNDATION

THE Rockefeller Foundation was chartered by special act of the New York State Legislature on May 14, 1913. The following statement of contributions and programs during this first decade is made by Edwin R. Embree, the secretary.

While the chartered purpose is broadly stated as "the well-being of mankind throughout the world," the work of the Foundation has become chiefly centered upon public health and medical education.

The expenditures during the first decade, 1913 through 1922, have amounted to seventy-six and three quarters millions ($76,757,040), roughly divided as follows:

Public health	$18,188,838
Medical education	24,716,859
War relief	22,298,541
All other philanthropic work	10,445,628
Administration	1,107,174

In carrying on its various activities the Foundation has expended all of its income from year to year and in addition seventeen and a half millions ($17,500,000) of its general fund or principal. A further sum of fifteen and a half millions ($15,500,000), payable in future years, has been pledged to various medical schools and public health projects.

Contributions outside the field of public health and medical education were made, for the most part, during the war and in the earlier years of the foundation's work before its policies and program had become clearly defined. The chief item in this group is the sum of five and two thirds millions ($5,678,599) given to various charities designated by the founder before he relinquished on July 19, 1917, the right he had originally reserved personally to direct the use of a part of the income. A million dollars was given to Herbert Hoover's child-feeding plan in Europe, and another to make possible the Palisades Interstate Park.

In the development of the foundation's program there has been increasing concentration upon medical education and public health.

The International Health Board, established as a department of the foundation in 1913, has sought to promote public health throughout the world by demonstrating the methods and costs of controlling certain diseases, notably hookworm disease, malaria and yellow fever; by fostering the growth of governmental health agencies; and by encouraging the formation of schools of hygiene. In carrying out this program the board has cooperated with twenty-seven American states and fifty foreign governments. Its annual expenditures have increased from $133,237 in 1914 to $1,842,249 in 1922.

In medical education a special feature has been the work of the China Medical Board, in building, equipping and maintaining a modern medical center in Peking. The board has made appropriations to other medical schools and to thirty-two hospitals, as well as to the fostering of science education in China.

Substantial contributions have been made in recent years to centers of medical teaching in London and Brussels. The foundation has also cooperated in the development of medical education in North and South America, Western and Central Europe, the Philippines, Hong Kong and Bangkok.

FELLOWSHIPS IN BIOLOGY OF THE NATIONAL RESEARCH COUNCIL

AT the meeting of the Board of National Research Fellowships in the Biological Sciences, held on April 25, 1923, the following appointments were made: E. G. Anderson, botany; L. R. Cleveland, zoology; R. T. Hance, zoology; M. J. Herskovits, anthropology; Leigh Hoadley, zoology; Marian Irwin, botany; Donald A. Laird, psychology; A. J. Riker, botany; Leslie Spier, anthropology.

On account of the short time available for receiving applications, it was decided to hold another meeting of the board toward the end of June for the consideration of deferred applications in hand and also of other applications that may be received prior to June 1st. Requests for information and application forms should be addressed to the Secretary, Board of National Research Fellowships in the Biological Sciences, 1,701 Massachusetts Avenue, Washington, District of Columbia.

SCIENTIFIC NOTES AND NEWS

THE Walker grand prize of $1,000 has been awarded by the Boston Society of Natural History to Dr. Leonhard Stejneger, head curator of biology at the United States National Museum at Washington, District of Columbia. The Walker annual prize of $60 has been awarded to William Seifriz of Yale University for an essay on "Colloidal properties of protoplasm."

THE gold medal of the Mining and Metallurgical Society of America for 1922, awarded to Robert Peele, professor of mining at Columbia, was formally presented to him on April 26 at a dinner held at the Aldine Club, New York City. The medal is given annually by the society "for distinguished service in the literature of mining."

AT its meeting in Baltimore on April 25 Professor E. V. McCollum, of the School of Hygiene and Public Health of the Johns Hopkins University, gave an address before the Tri-State Medical Association on "The influence of diet on bone and tooth development." In recognition of Professor McCollum's researches

in this field the association presented him its Stephen A. Trimble medal.

AT the recent celebration of the fiftieth anniversary of the establishment at the State University of Iowa of the first department of education, the honorary degree of doctor of laws was conferred on Dr. Edward Lee Thorndike, professor of education and director of the Institute for Educational Research at Teachers College, Columbia University; on Dr. Charles Hubbard Judd, professor of education and dean of the School of Education of the University of Chicago; on Dr. Ellwood P. Cubberley, professor of education and dean of the School of Education at Stanford University, and on Professor James E. Russell, dean of Teachers College, Columbia University.

THE Anthropological-Geographical Society of Stockholm has conferred the Anders Retzius medal in gold upon Sir Aurel Stein for his archeological research in Central Asia.

PROFESSOR J. PROUDMAN, director of the Liverpool University Tidal Institute, has been awarded the Adams Prize of the University of Cambridge for an essay on "The theory of the tides." The essay submitted by Dr. H. Jeffreys has been highly commended by the examiners.

AT the annual meeting of the British Iron and Steel Institute on May 10, the Bessemer medal was presented to Dr. W. H. Maw.

PROFESSOR NUTTALL and Professor Sir W. J. Pope are to be appointed to represent the University of Cambridge at the ceremonies connected with the centenary of the birth of Pasteur, which will be held in Paris and Strasbourg next month.

DR. LOUIS O. KUNKEL, pathologist of the experiment station of the Sugar Planters' Association of Honolulu, Hawaii, has been appointed head of the work in plant pathology of the Thompson Institute for Plant Research at Yonkers, New York. Dr. Kunkel, with a protozoologist and several others representing various sorts of biological technic, will devote his time to the study of "aster yellows" and other mosaic types of disease.

DR. BERT W. CALDWELL has been appointed superintendent of the university hospital at the University of Iowa by the State Board of Education to succeed Dr. Arthur J. Lomas, who has gone to a post at the University of Maryland. Dr. Caldwell comes from Vera Cruz, Mexico, where he was a member of the yellow fever commission.

SIR HENRY M. W. GRAY, of the Aberdeen Royal Infirmary, has accepted the appointment of chief of the surgical staff of the Royal Victoria Hospital, Montreal.

DR. P. A. MAPLESTONE, who is a graduate of the University of Melbourne and has until recently been lecturer of protozoology in the Liverpool School of Tropical Medicine, has been appointed assistant director of the Research Laboratory at Sierra Leone.

F. W. WILLARD has been appointed superintendent in charge of chemical engineering, development and research for the general manufacturing department of the Western Electric Company's Hawthorne Works, Chicago, Illinois.

THE division of chemistry and chemical technology of the National Research Council, Washington, D. C., has named James R. Withrow, of the Ohio State University, as chairman of the National Research Council Committee on the use of sodium compounds as a substitute for potassium compounds, both in scientific and industrial work.

APPOINTMENT of four members of the committee to conduct an investigation of the storage of coal is announced by the Federated American Engineering Societies. They are: P. F. Walker, dean of engineering, University of Kansas; S. W. Parr, professor of applied chemistry, University of Illinois; H. Foster Bain, director of the United States Bureau of Mines; L. E. Young, Union Light and Power Company, St. Louis. The chairman is W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, Chicago. Four or five additional members of this committee are yet to be selected. Consideration is being given to recommendations by member organizations and it is probable that the committee will be completed in the near future.

THE British secretary for mines has appointed the following to be additional members of the Safety in Mines Research Board: Professor W.

S. Boulton, Professor S. M. Dixon, Dr. J. S. Haldane, Professor C. H. Lees and Professor J. F. Thorpe.

AT a meeting of the permanent committee of the International Society of the History of Medicine, held at Antwerp on April 11, 1923, it was voted to hold the Fourth International Congress of the History of Medicine at Geneva, Switzerland, during the third week of July, 1925. The following officers were elected: *President:* Dr. Charles Green Cumston, Geneva. *Secretary General:* Dr. A. de Peyer, Rue General Dufour, 20, Geneva. *President of honor:* Sir D'arcy Power, London. *Vice-presidents of honor:* Dr. Edward B. Krumbhaar, Philadelphia; Dr. J. G. de Lint, Gorinchem, Holland; Dr. Tricot Royer, Antwerp; Dr. Charles Singer, London; the president of the Medical Society of Geneva for the year 1925.

T. GILBERT PEARSON, president of the National Association of Audubon Societies, sailed for France on May 12. He is going in the interests of furthering the organization and work of the International Committee for Bird Protection, of which he is founder. The committee is composed of representatives elected by leading scientific and conservation organizations in the United States, Canada, Australia, Norway, England, Holland, Luxemburg and France. He goes to Europe as representative of the National Association of Audubon Societies and the American Ornithologists' Union to address the International Convention shortly to be held in Paris under the management of the Societé de Nationale d'Acclimatacion de France.

R. P. ROSE, chemical engineer of the United States Rubber Company, has returned to this country after having spent two years in Sumatra, where he installed plants for the utilization of the Hopkinson process for producing rubber and equipment for the shipment of latex.

DR. M. LUCKIESH, director of the Nela Laboratory of Applied Science of the General Electric Company of Cleveland, delivered an address at Toronto before the Royal Canadian Institute on the subject "Artificial light and civilization" on April 21.

PROFESSOR BAKULE, of Prague, Czecho-Slovakia, gave a lecture and demonstration under the auspices of the St. Louis School of Occupational Therapy at Washington University School of Medicine on May 1. He is touring the United States with a group of handicapped children, whom he has trained to become adept at some gainful occupation. Many of the children would ordinarily be considered as hopelessly incapacitated for life, but instead of being private or public charges, they are able to contribute not only to their own maintenance but to others as well. Briefly stated, his methods are based on appeals to curiosity and direction of their activity along the desired lines.

PROFESSOR EMMANUEL DE MARGERIE, director of the Geological Map Service of Alsace and Lorraine, gave a series of six illustrated lectures on geology at Yale University, beginning on May 7 and continuing through May 15. Professor de Margerie is visiting the United States under a plan perfected by the committee of American Universities on exchange with France of professors of applied science and engineering, with assistance of the Institute of International Education. This committee represents seven institutions: Columbia, Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, University of Pennsylvania and Yale. The topics of these lectures by Professor de Margerie are: "The topographic map of France," "Brief history of the geology of France," "Structural work in the Paris basin, Northern France and Belgium," "The Jura Mountains," "The Western Alps in France and Switzerland," "Provence," "The Pyrenees," "The Western Mediterranean basin."

THE twenty-ninth James Forrest lecture of the Institution of Civil Engineers, London, was delivered on May 4 by Sir Richard Glazebrook, who took as his subject "The interdependence of abstract science and engineering."

THE Adolph von Baeyer Memorial lecture was delivered before the Chemical Society, London, by Professor W. H. Perkins, on May 10.

MR. F. W. HARMER, for more than fifty years a fellow of the Geological Society and well known for his studies of pliocene mollusca, died on April 24, aged eighty-seven.

THE death is announced of Dr. V. Th. Homén, professor of applied physics in the University of Helsingfors, aged seventy-five years.

A MESSAGE received at the Harvard College Observatory from the Rev. Joel H. Metcalf of Portland, Maine, announces the discovery of a comet by him on May 7 in the constellation Ophiuchus, near the star Alpha Opiuchi. The comet was of the ninth magnitude, much too faint to be seen without a telescope, and was moving slowly. It appeared round and brighter on the southwest side. Another telegram received at the observatory from the Lowell Observatory, Flagstaff, Arizona, announces the discovery of a new star by Lampland on May 5 in the great spiral nebula Messier 83. The nova was roughly of fourteenth magnitude, which indicates that it would be visible only with a powerful telescope.

THE discovery announced last year by workers in the Toronto University that an extract from the pancreas of animals is a palliative of diabetes, and the later discoveries that the active substance, called "insulin," can be prepared from the pancreas of fishes, have suggested that the development of this possibility might be of considerable importance in the fisheries of this country. Accordingly, The Fisheries Bulletin reports that arrangements have been made by the Bureau of Fisheries and the hygienic laboratory of the Public Health Service to cooperate in an investigation of the possible production of insulin from fishes. The Bureau of Fisheries is to do the field work in studying the sources and collecting the material, while the hygienic laboratory is to do the laboratory and experimental work, including preparation and standardization of the pancreas extract. A. A. Ellsworth, who is doing the field collecting, went to Fernandina, Florida, in April, where he is now collecting pancreas from sharks at a shark fishery. About 36 sharks a day are being taken. The pancreatic glands of each shark weigh 200 grams or more (around one half pound). It may be noted that the viscera of fish when used at all are used for producing fertilizer and oil, low-priced products. This is the first effort to produce high-priced biological products for medicinal purposes from the glands of fishes. Fish, of course, contain the numerous glandular substances that are found in other animals.

THE British Colonial Office, as reported in the London *Times*, makes the following announcement respecting the *Discovery's* new voyage: The secretary of state for the colonies has appointed an executive committee to control the researches recommended by the Inter-Departmental Committee on Research and Development in the Dependencies of the Falkland Islands, and in particular the investigation of the question of the preservation of whales and of the whaling industry, which has been subject to government regulation since its inception nearly twenty years ago. The members of the committee are as follows: Mr. Rowland Darnley (chairman), Colonial Office; Sir S. F. Harmer (vice chairman) British Museum, Natural History Department; Mr. H. T. Allen (financial member), Colonial Office; Mr. J. O. Borley, Ministry of Agriculture and Fisheries; Captain Robert W. Glennie, R.N., Admiralty; Mr. J. M. Wordie, Royal Geographical Society; and Sir Fortescue Flannery, of Messrs. Flannery, Baggallay and Johnson, consulting naval architects to the Crown Agents for the Colonies, who has consented to serve as a member of the committee until the *Discovery*, which has been purchased for the purposes of the research expedition, has been reconditioned. The *Discovery* is Captain R. F. Scott's old ship, in which also Sir Ernest Shackleton served. She will be principally employed in the waters of South Georgia and the South Shetlands. It is not anticipated that she will be ready to start before next year.

As headquarters for a geological field station ten acres of land in Ste. Genevieve County, Missouri, were given to the University of Chicago in 1921 by one of its graduates, Mr. William E. Wrather, a geologist of Dallas, Texas. At the same time the donor provided a concrete building for kitchen and dining room purposes and a concrete springhouse to protect the water supply. Through the generosity of the donor also two new buildings are now being erected, one for dormitory purposes, to accommodate twenty students, and another to provide facilities for shower baths. Field instruction in geology has been conducted by the university in Ste. Genevieve County each season since 1914, except during the two war years, 1917-18.

The establishment of the permanent camp has made possible much more efficient class work. The region available for study exhibits a remarkable variety of geological phenomena in a small area. The whole district studied is about five or six miles long and less than three miles wide, and the permanent camp is situated near the center. Within this area more than twenty-five distinct geological formations are outcropping, ranging in age from the Cambrian to the Mississippian, most of them being more or less abundantly fossiliferous. In addition, unusual fault phenomena provide problems of great interest for class work, while there is a remarkable opportunity for the collection of fossils from numerous Paleozoic horizons. It is proposed in the near future to expand the work at the Field Station into a real Field School of Geology and to continue it throughout the summer quarter, with a number of distinct courses and the proper instructors for each.

EMPLOYING the methods of engineering, research in eye conservation on a nationwide scale has been undertaken by the Eyesight Conservation Council of America. The work is in charge of J. E. Hannum, a former member of the teaching staff of Purdue University and a member of the American Society of Mechanical Engineers. The plan, which follows revelations of human and industrial waste in industry, made by the Hoover Committee on the elimination of waste in industry of the Federated American Engineering Societies, of which J. Parke Channing of New York is chairman, aims to determine the extent to which attention is being given to the conservation of vision in the educational, commercial and industrial activities of the United States. A study of statutory provisions now in force and affecting eyesight will be carried on. Experiments to determine the true economic value of perfect vision will be made. It is proposed to measure the improvement in health, increase in quality and quantity of production, advancement of individual performance and decrease in losses due to waste and accident. Factory, home and school lighting, now a subject of scientific research here and abroad, will be studied. Mr. Hannum, a former Indianapolis engineer, is a graduate of Pennsylvania State College, and was formerly connected with the Red Cross Institute for the Blind in Baltimore.

UNIVERSITY AND EDUCATIONAL NOTES

THE committee of the Associated Harvard Clubs which is raising $250,000 to endow five professorships at Berea College, Kentucky, in memory of Professor N. S. Shaler, the Harvard geologist, has been continued for another year to go on with its campaign, which has already secured more than $50,000.

WINTHROP MORE DANIELS, a member of the Interstate Commerce Commission, has been appointed to the newly established chair of transportation at Yale University.

DR. B. B. BRACKETT, who has for the past fourteen years been the head of the electrical engineering department at the South Dakota State College, has accepted a professorship of electrical engineering in the college of engineering of the University of South Dakota.

DR. H. M. DADOURIAN, associate professor of physics at Trinity College, Hartford, Connecticut, has been appointed Seabury professor of mathematics.

DR. R. W. WHYTLAW-GRAY, science master at Eton College, has been appointed professor of chemistry at University College, London, in succession to Professor Arthur Smithells.

We learn from *Nature* that Dr. S. P. Smith, assistant professor in the City Guilds (Engineering) College, Imperial College of Science and Technology, London, has been appointed professor of electrical engineering at the Royal Technical College, Glasgow, in succession to Professor Magnus Maclean, who is about to retire after occupying the chair for twenty-four years.

DISCUSSION AND CORRESPONDENCE

AS TO THE CAUSES OF EVOLUTION

ABOUT a year ago I published a note (SCIENCE, April 14, 1922) on the evolution controversy. In this I spoke of the causes of evolution. It has come to my attention that my remarks on this subject have been considerably misunderstood. And it now appears

that one of these misunderstandings is likely to be used in a way I should not like. Consequently, another note seems to be in order, this one dealing with the subject not incidentally as the other did, but directly.

A cardinal element in my theory of causality as applied to evolution is indicated by the fact that I always speak of the *causes* and never the *cause* of evolution. A multiplicity of causes is the point. Probably few biologists now fail to recognize that more than one cause has always been and still is operative in producing the living world. Nevertheless, it strikes me that few there are who accept the principle of cooperating causes, not in organic production merely, but in all natural processes, as wholeheartedly as by right it should be accepted.

While many evolutionists show a sort of grudging assent to the idea by speaking of "causal factors" or just "factors," they appear to harbor the notion that after all there must be one King Cause, as we may say. This, some stoutly maintain, or did until recently, has been discovered. Instances: Some of the polemics in favor of natural selection, or mutation, or the inheritance of acquired characters. But such discussions are becoming less frequent than they were and this is a real gain.

Such a state of mind on the subject is, I strongly suspect, a hold-over of the old theological idea of one Great Primal Cause. The later doctrine of "first" causes and "second" causes appears to have been a compromise forced upon the original idea by progress in natural science.

As concerns the origin of species, I wonder if the causal difficulties, great though they unquestionably are, have not been magnified by a mere verbal accident, as it may be called. Has not the substitution of the word evolution for that of development been a great misfortune in this matter? It seems to me so.

I do not believe there is a thing in the phenomena of origination in living nature that justifies any distinction between the two words as applied to those phenomena. Dictionary definitions certainly warrant this view. But much more convincing is the fact that neither Lamarck nor Darwin, the two major prophets of modern transformism, hardly used the term evolution at all, though both made much use of development. In later practice, however, a very sharp distinction between the words has undoubtedly grown up. And one result of this seems to have been to make us hope and strive for causal explanation when we use the term evolution in a sense in which we do not any longer when we use the term development. So marvelous is the beguiling power of words!

Do working horticulturalists, stock-raisers or embryologists nowadays think of such a thing as some one cause or even of just a few completely discoverable causes of development of the individual plants and animals and embryos with which they work? Certainly not. And, it should be noticed, the case is not different when they think of the varieties and races with which they work.

Unquestionably the problem of what causes that crucial step in the origin of species which makes them sexually incompatible with all other species is one on which we have little light as yet.

But how justify, either by fact or logic, the widely prevalent seeming assumption that whatever causes this particular step is the cause of the origin of species and hence of organic evolution, par excellence?

Certain is it that the races, varieties, subspecies, etc., with which we are familiar are naturally caused somehow. And if these may become true species, as Darwin believed and most naturalists believe, by what hocus pocus of reasoning can we exclude variety-producing causes from being also species-producing causes, the moment the varieties become species? Reasoning of this kind would require us to say that the causes which produce the sapling can not be included among those which produce the tree.

What I am standing for is the factual truth, and the scientific importance of the principle of many cooperating causes in organic development. Whether the development be of individuals, of varieties, in nature or under cultivation, of subspecies, of full-fledged species, of genera, or what not, matters not at all.

And I would insist that if in formal biology the principle could be viewed and discussed in this common sense way much of the futile or worse controversy within the biological realm, and the bewilderment among intelligent people

outside of that realm, would disappear. For it would be recognized on all hands that very much is known about the causes of all development even though certain steps, notably that by which species become differentiated sexually from other species, are still very obscure as to causation. No sane person could then make the charge, now being made by persons who undoubtedly are sane, that biologists "know absolutely nothing at all about the cause of evolution." Nor would even a fundamentalist Bishop be likely to announce himself (as one has recently been reported to have done) as standing four square against evolution, if evolution and development were everywhere recognized as being one and the same thing.

And the gain to clear thinking in biology itself would also be great in that the idea, often as vehemently defended as it is vaguely held, would vanish, that certain supposed causes of evolution must necessarily exclude one another.

What real justification is there, to illustrate, for assuming that if natural selection is a true cause of evolution, the inheritance of acquired characters must be denied—or vice versa? Darwin's position on this was beyond question logically sound. For him there was no *a priori* exclusiveness as between the two. It was solely a matter of evidence—of objective evidence. And so in the nature of the case is it to-day and so it will remain. Does anybody really believe that should one or more of the strong indications recently brought to light of the heritability of somatic modification be fully proved, natural selection would thereby be disproved?

It will be a great day for science when she shall have gained such a mastery over her mental technique that while speculative thinking shall continue to supplement and extend common sense thinking, it shall no longer destroy it.

WILLIAM E. RITTER
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MARINE PLEISTOCENE FOSSILS FROM NEW YORK CITY

RECENTLY a fossil bivalve was sent by Stanley N. Shaw, editor-in-chief of the *Federal Reserve Club Magazine*, of New York City, to the geology department of Cornell University for the determination of its character and history.

The shell was uncovered on September 30, 1922, by the workmen in excavating for the foundation of the new Federal Reserve Bank which occupies the block between Nassau, Liberty, William Streets and Maiden Lane; the specimen excited the interest of the officials and consequently was sent to Cornell. Three other shells and a piece of wood were also discovered at the same locality and later sent. These fossils prove to be of Pleistocene age and belong to the following species:

Venus mercenaria Linnæus cf. *antiqua* Verrill—right and left valve.

Alectrion (Ilyanassa) obsoleta Say—2 specimens.

Chamæcyparis (cypress, white cedar) or *Thùja* (arbor vitæ).

The wood has in places a coating of blue clay as well as flakes of mica. The shells are discolored by a bluish clay.

The following is the section as sent with the specimens:

29.8 feet, high curb level.
10.7 feet, old cellar bottom.
0 feet, high water level.
22 feet, sand.
38.7 feet, hardpan.
55.5 feet, hardpan, sand, clay and boulders.
64.5 feet, hardpan, gravel and boulders.
67.8 feet, disintegrated rock.
Base of foundation of Federal Reserve Bank, bed rock—(core sample norite, possibly a phase of the Palisade trap). "This is undulating and varies from a depth as here noted to a depth of 117 feet below curb."

The shells were found 60 feet below the high water level, in the layer of hardpan, gravel and boulders.

The specimens of *Venus mercenaria* are thick, more rounded posteriorly than the recent shells of the same species and vary from the living form in that the concentric ribs are prominent, coarse, lamelliform ridges which extend over the entire surface of the shell, covering the middle region which in the recent shells is characteristically smooth. The characters are like those described by Verrill for forms from the Post-Pliocene of Sankoty Head, Nantucket Island, Massachusetts, to which he gave the varietal name *antiqua*. *Venus mercenaria*, with

its numerous variations and mutations, dates back to Miocene time and is abundant to-day along the Atlantic coast, ranging from Florida to Massachusetts, and locally on the southwest coast of Maine and southern shores of the Gulf of St. Lawrence and Bay of Chaleur, from low water to 8 fathoms. *Ilyanassa obsoleta* also ranges from Miocene to Recent. Both of these species have been reported from well drillings on Long Island, including east New York City. They are from Pleistocene sediments (Veatch, Merrill, etc.). *I. obsoleta* is to-day one of the common small species of the east coast and ranges from Nova Scotia to Tampa, west Florida, from littoral to 2 fathoms.

The specimens are interesting in that they indicate marine sedimentation within the limits of New York City in Pleistocene or Glacial time. A further and exact study of the sediments of the section at the locality where the shells were discovered might reveal at what stage of that time the marine deposition took place and if the sea occupied the region where the shells were found or if they were transported by flowing water from a near beach and dumped with the drift and bowlders. The officials and workmen connected with the Federal Reserve Bank are to be commended for the collection and interest which they have shown, the result of which is the establishment of a new locality of Pleistocene marine sediments in the New York City area.

KATHERINE VAN WINKLE PALMER
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EVOLUTION IN WEST VIRGINIA

BY special invitation, Honorable William Jennings Bryan recently addressed the legislature of West Virginia while it was in session at Charleston. Following this address Mr. Bryan made a tour of the state and gave anti-evolution addresses in several of the larger cities.

A bill prohibiting the teaching of evolution in all state-supported schools had already been introduced into the legislature. Just before the adjournment of the regular session, in the latter part of April, an advocate of the measure attempted to have the bill brought before the House, but the motion was lost and the bill was never allowed to come to vote.

It is stated that the address of Mr. Bryan in Charleston made practically no impression upon the members of the legislature.

One of the bitterest and most active opponents of the teaching of evolution, a minister of Morgantown, has been called to a higher sphere of usefulness (?) in Cincinnati and it is hoped that the anti-evolution agitation in the state has been permanently disposed of.

A. M. REESE

THE REPORTED ERUPTION OF LASSEN PEAK

SEVERAL times within the early months of this year Lassen Peak has been reported by newspapers of that region as in volcanic eruption. To settle conflicting reports I requested George Olsen and Charley Yori, well-known mountaineers of California and Alaska, to climb snow-clad Lassen Peak and determine the record, if any, made by the fall of volcanic ashes in the winter snow. Their letter of May 2 states: "There has been no eruption, as the snow is clean, no visible ash line in it and the crater where the eruption is supposed to have been has clean snow several feet deep covering the entire bottom of it and all other places where an eruption might have occurred show no sign of an eruption."

J. S. DILLER
Geologist
UNITED STATES GEOLOGICAL SURVEY

QUOTATIONS

PROPOSED INTERNATIONAL ASSOCIATION OF BRAIN WORKERS

SOME three years ago M. Henri de Jouvenel, one of the French delegates to the League of Nations, succeeded in establishing in France a *Confédération des travailleurs intellectuels.* This was the first national association of brain workers and now has 150,000 members; similar associations have been formed in eight other countries. A meeting of representatives of these associations was held recently at the Sorbonne, the headquarters of the University of Paris, with the countenance of the French government and under the honorary presidency of M. Léon Bourgeois, one of the most universally respected of French statesmen. It was attended also by "observers" from nine other countries.

Among the "observers" present were persons nominated by the several British societies, among others the British Medical Association, which was represented by Dr. Gustave Monod. The meeting first of all received communications with regard to the position in various countries and after a brief discussion it was decided to found a *Confédération internationale des travailleurs intellectuels*—that is to say, an international association of brain workers. A committee was appointed consisting of two delegates from each of the eight countries having an organized confederation, and an "observer" from each of the other countries represented; the latter having only consultative privileges. This committee was instructed to take steps to invite those countries which had not already done so to establish associations of brain workers and to draw up a constitution for the international association; the draft is to be submitted to the national organizations and afterwards considered at a meeting to be held in Paris before the end of this year. Dr. Monod informs us that medical societies in France are beginning to join the French confederation. The Association Générale des Médecins de France joined a short time ago and on April 11th the members of the Therapeutic Society of Paris, a purely scientific body, unanimously resolved to join also. Among the objects the organization has in view is the prolongation to eighty years of the period during which the author has a property in artistic and literary creations and to extend this principle to scientific workers. With this object it will seek to bring into existence an international code governing the right in intellectual property.—*British Medical Journal.*

SCIENTIFIC BOOKS

The Racial History of Man. By ROLAND B. DIXON. New York, Charles Scribner's Sons. 583 pages. $6.00.

DURING the last quarter of a century, particularly since the development of studies on heredity, the attempts to unravel the history of human types have been based more and more on the investigation of morphological forms. The more mechanical classifications according metrical features which dominated anthropological inquiry during the end of the past century do not play as important a part as they used to do. An excellent instance of this kind is the detailed investigation of the history of the Melanesian-Australian type given by Sarasin in his study of New Caledonia.[1] The same tendencies manifest themselves in the study of the ancient remains of man, particularly of those belonging to the paleolithic period. It is recognized more and more clearly that metrical values must be considered merely as a means of a quantitative statement of descriptive features.

Professor Dixon's attempt to unravel the racial history of man runs counter to this whole development. His book is based on the thesis that three measurements of the head—length, breadth and height—and two measurements of the nose—height and breadth—have remained stable since paleolithic times. The second hypothesis on which his analysis is based is the assumption that all those human types which are characterized by the extreme forms of the length-breadth and length-height index of the head and the height-breadth index of the nose are primary forms and that all intermediate forms are due to intermixture between these primary forms. In this way he obtains necessarily eight fundamental races, representing the eight possible combinations of three independent features.

From a biological point of view it is difficult to see how these two fundamental hypotheses could be maintained. First of all, we have no evidence that human types may be considered as absolutely stable. It is true that not all types of organisms react equally energetically to environmental influences, but there is no evidence that would permit us to assume that man is absolutely resistant to them. We have the best possible evidence that the size of the body and proportions of the limbs are strongly influenced by environment and, so far as I can see, no observations have been made that would contradict my own observations on the changes of head and face form of immigrants in the United States and of the descendants of Spaniards living in Porto Rico. The proof may not have been given that the differences between town population and country population ob-

[1] Fritz Sarasin, Anthropologie der Neu-Caledonier und Loyalty-Insulaner, Berlin, 1916-1922.

served in Europe is due to direct environmental influences, but even if we assume with Ammon[2] that it is due to selection, it would show that the constitution of a group of people may be materially changed.

The strongest argument in favor of the plasticity of skeletal form is shown in observations of domesticated animals. Changes in head form and in size of the skull have been observed not only in many domesticated animals, but also among animals born in captivity. Differences have been observed between wild lions and lions born in zoological parks and between wild rats and rats raised in cages. Attention has been called by Eduard Hahn and by the writer to the fact that men must be considered a domesticated form and this thesis has been most fully worked out by Eugen Fischer and recently by Berthold Klatt.[3] With these observations in mind, the thesis of the absolute stability of human forms from paleolithic times to the present would require proof before it could be accepted. This view is practically a restatement of the thesis of J. Kollmann, who considered the modern human types as "dauerformen."

In order to maintain the second hypothesis, Professor Dixon has assumed (page 17) that the three features which he discusses are not subject to Mendelian inheritance. While we do not know in detail how the three features are inherited, there is fairly conclusive evidence that there is a tendency towards reversion to parental types. A study of the data collected by Walter Scheidt[4] shows clearly that the formation of middle types as a result of crossings is not probable.

It would seem to the reviewer that an attempt to establish the extremes of a variable series as fundamental types is based on a misconception of the meaning of variability. We know from the studies of inbreeding carried out by Miss King[5] on rats and by Johannsen[6] on beans that even in extreme cases of long continued inbreeding there will always remain a considerable amount of variability. This is not surprising considering the complexity of the organism and the many ways in which it is subject to formative influences which can never be fully controlled. We are fairly familiar with the variability of the two head indices and of the nasal index. If we assume for a moment that we have a human type which, in regard to the three classes established by Professor Dixon, occupies exactly a middle position and if we assume furthermore that the variability in this group were equal to one half of the space occupied by the middle group and if, furthermore, we disregard the correlations between the various measurements, we should find that in a group of this kind all the extreme groups would be represented by 0.5 per cent. of the whole series; all the groups containing two extreme forms and one middle form would be represented by 1.8 per cent.; those representing one extreme and two middle forms each by 7.6 per cent. and those representing three middle forms by 28.7 per cent. As a matter of fact, the variability here assumed for the three ratios considered by Professor Dixon is lower than the normal variability that occurs in any given type and we would have to say, therefore, that in a group of people of this kind all the extreme forms would be represented. Professor Dixon would go on and say that all the middle forms are mixed and he would thus obtain 12.5 per cent. for each one of his primary types as the ancestry of the group. The assumption that the variability of a series of this kind is due to mixture is entirely arbitrary. In short, the proof is not given that the extreme forms are actually fundamental forms. On the contrary we should rather be inclined to assume that the extreme forms are due to certain excessive conditions that determine the particular form of the individual in question.

It seems, therefore, that the theoretical basis of the whole investigation would require proof of the two fundamental hypotheses and this the author fails to give and it is my belief that it cannot possibly be given.

It is, of course, true that the human races have intermarried to such an extent that the attempt to find a pure race anywhere is futile. Notwithstanding this fact, we ought not to

[2] O. Ammon, Zur Anthropologie der Padener, Jena, 1899.

[3] Mendelismus, Domestikation und Kraniologie, *Archiv für Anthropologie*, 1921, xviii, 225.

[4] Familienkunde, Munich, 1923, pages 75-109.

[5] Studies on inbreeding, Philadelphia, 1919.

[6] W. Johannsen, Elemente der exakten Erblichkeitslehre, Jena, 1909.

overlook the similarity of the phenomenon to the analogous variability of plants and animals which occur over extended areas. Exactly the same method might be applied to forms of bears or to forms of mice. Here also extreme forms might be established and all the intermediate forms might then be explained as due to mixture. This simplification of the problem would, however, hardly appear justifiable because here, also, the dogmatic assumption would be made that the forms are permanent and not in any way subject to environmental influences.

The difficulties of these hypotheses made by the author appear very clearly when he compares his fundamental types as occurring in different parts of the world. As might be expected he does not find any kind of correlation between the ratios which he studies and other anatomical traits such as pigmentation, hair form and so on. It is quite obvious that when we compare long-headed, high-headed, flat-nosed individuals living in the Alps of Europe with similarly proportioned individuals from Australia and West Africa, there must be serious differences in regard to other traits. Because Professor Dixon assumes that these three values are fundamental, he is compelled to assume that none of the other traits are permanent and are all subject to change. No attempt is made to prove this conclusion which is merely an inference drawn from the assumed permanence of the given traits. It is, of course, true that there is a possibility that features like kinky hair may have developed independently in different races, as Sarasin assumes, but this assumption does not overcome the objections based on the failure to consider any other bodily features.

On account of our fundamental disagreement with the general position of the author it does not seem advantageous to enter into a detailed discussion of the distribution of the various types which is given in a number of maps. It must be understood, of course, that the maps are analogous in character to the usual maps showing the distribution of, for instance, short statures and tall statures, or low cephalic index and high cephalic index and that all of these are only fragmentary reproductions, because the plotted values depend upon two factors, the average and the variability of the measurements. The author's maps ought to be labeled as expressing approximately the frequency of occurrence of certain combinations of features. The maps certainly do not prove that these are fundamental races.

It is quite impossible to check up the data contained in the book because the general tables are not given. This is obviously impossible in a book which evidently is intended to appeal not only to the specialist but also to the general reader, but furthermore, the summary tables given on page 22 and those contained in the conclusion do not agree and the numbers are so small that any general inferences drawn from them seem rather risky.

In the final chapter Professor Dixon tries to prove that those groups which agree in regard to the selected ratios also agree in regard to other metric features. He uses for this purpose a series of fourteen measurements, eight of which are the length, breadth and height of the head and length and breadth of nose and the three ratios on which his whole system is built up. He tries to show that the six remaining measurements agree. One of these is the breadth-height index which is derived from the same material as the length-breadth and length-height indices. The others are the bi-zygomatic diameter, two facial indices, the gnathic index and the capacity of the skull. It is not surprising that the measurements on which his classification is based should agree fairly well. However, in my judgment, the rest do not show any satisfactory agreement, particularly considering the small number of individuals upon which the comparisons are based.

A word should be said also in regard to Professor Dixon's general attitude towards the question of the relation between racial ability and anatomical form. In one place he expresses himself as quite convinced that achievement proves hereditary ability (page 518). I can not consider this argument conclusive. If it were valid, then at different periods it would justify entirely different views. It is not very long since Russia would have seemed in cultural achievement very much inferior to western Europe. The conclusion as to racial inferiority is in this case contradicted by the considerable number of eminent scientists

and artists produced by Russia since social conditions have changed. If the ancient Greeks or still earlier the Egyptians or Chinese had used the same argument, they would have classified the northern Europeans as belonging to an inferior race, incapable of ever attaining cultural eminence. The proof of racial superiority certainly has to be based on other evidence. It is curious to note that when it suits the author's emotional attitude he changes his argument completely and indulges in flings at the assumed claim of racial preeminence on the part of the Germans—an attitude which hardly helps to make convincing a treatise that attempts to be scientific.

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SPECIAL ARTICLES

PHYSICO-CHEMICAL BASIS OF PSYCHIC PHENOMENA

EVER since Galvani discovered the relation between an electric current and muscular action there has been a feeling among scientists that the nerves are electrical conductors and that nerve impulses are really electrical currents. There has, however, been no satisfactory explanation as to how the conductivity of the nerve could be changed by the action of narcotics and nerve stimulants, as it must be changed to account for the effect of these substances on nerve impulse and psychic phenomena in general.

The explanation of the action of these compounds on the nervous tissue is very simple and in accord with the known facts concerning the composition of nervous tissues and the chemical and physical properties of narcotics and nerve stimulants. It is also based on well-founded laws of physical chemistry and is subject to laboratory verification.

This explanation postulates that the nervous tissue, which is composed of from 10 to 15 per cent. of lipins and from 70 to 85 per cent. of water, is essentially a two phase system of two immiscible liquids. One of these phases is a water solution, the other is a lipin solution. The relative dispersion of these two phases will depend upon their interfacial tension and on their relative internal pressure.

Any substance which will dissolve in the lipin phase and lower its surface tension but will not dissolve in the water phase will have a tendency to cause the lipin phase to become more continuous and for the water phase to become less continuous. Since the lipin phase is a poorer conductor than the water phase the conductivity of the nerve will be reduced as the lipin phase becomes more continuous. Any substance that will produce this result will be a narcotic. On the other hand any substance which will dissolve in the water phase and lower its surface tension but will not dissolve in the lipin phase will cause the water phase to become more continuous and the lipin phase less continuous, thus increasing the conductivity of the nerve. Such a substance will be a nerve stimulant.

This hypothesis will coordinate the following well-known, but apparently isolated facts:

A. The nervous tissue has a very high percentage of lipins.

B.[1] In a two phase system where the phases are immiscible liquids, either phase can be made continuous by dissolving in them a substance having the proper distribution coefficient and at the same time having the desired effect on surface tension.

C.[2] The narcotic action of a compound depends on its distribution coefficient between lipins and water.

D.[3] Not all substances which have a distribution coefficient which shows them to be much more soluble in lipins than water are narcotic in their action. In addition to this solubility in lipins the substance must lower the surface tension of the lipin phase to be narcotic.

E.[4] Narcotics do not form a definite chemical compound in the nervous tissue but are adsorbed.

F.[5] Surface tension is a factor in the action of narcotics.

G.[6] Too great a preponderance of sodium

[1] Clowe's *Jour. Phys. Chem.*, xxix, 407, 1916.

[2] Overton, "Studien über narcose," Jena, 1901.

[3] Curliny, "Text-book of Pharmacology," p. 128, 1904.

[4] Moore and Roaf, *Proc. Roy. Soc.*, 73, 1304.

[5] Traube view as reported on page 48 of "The chemistry of synthetic drugs," by Percy May, 1921.

[6] Frederick F. Tisdall, Vol. LIV, 35, 1922.

over calcium in an animal will produce tetany.

H.[7] Narcotics lower the metabolism of nervous tissue.

I. Sodium increases the permeability of cell while calcium lowers it.

This hypothesis affords an explanation of the make and break of contact at the synapses. The contact is broken so far as conductivity is concerned, when the lipin phase is on the outside, that is, when it is continuous. The contact is made when the water phase is on the outside.

This changing of the phases of the water-lipin two phase system will also account for many other little understood phenomena of other living cells and brings into coordination many isolated facts in the field of biology.

If experiments which are now being conducted in this laboratory bear out the above hypothesis it will be of great value to those interested in the manufacture of synthetic drugs. It will give the neuro pathologist a real basis on which to work. But, still more important, it will give to the experimental psychologists the physical basis for nerve impulse for which they have been searching without success and will establish psychology as a truly natural science.

J. S. HUGHES
H. H. KING

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THE NATIONAL ACADEMY OF SCIENCES

THE annual meeting of the National Academy of Sciences was held in Washington on April 23, 24 and 25, when the following scientific program was presented:

AFTERNOON SESSION

Important mammals and reptiles recently discovered by the Third Asiatic Expedition in the heart of Mongolia, and their significance: H. F. OSBORN.

Asiatic relationships of American Pliocene faunas: J. C. MERRIAM.

Preliminary report on the life zones of Ecuador: DR. FRANK M. CHAPMAN. A study of the results of the field work in Ecuador, extending over a period of ten years, confirms previous conclusions in regard to the zonal distribution of bird-life based on similar data from Colombia. Both the character of the avifauna and the altitude of zones in southwestern Ecuador have, however, been strongly affected by a branch of the Humboldt current which washed the Ecuador coast north to about 1 degree S. lat. Four life-zones exist in Ecuador between sea-level and snow-line, a tropical, subtropical, temperate and paramo. The tropical zone in eastern Ecuador is wholly humid and composes the Ecuadorian portion of the Amazonian fauna. The tropical zone in western Ecuador contains two strikingly unlike faunas, one of which is humid and of northern, the other of which is arid and of southeastern origin. The more northern, extending southward on the coast to about 30 degrees S. lat., is the southern end of the Colombian-Pacific fauna which occupies the tropical zone of western Colombia and eastern Panama. For the more southern part of the tropical zone of western Ecuador, the name equatorial arid fauna is proposed. Climatically, this is a transition area between the humid coastal region of Colombia and northwestern Ecuador, and the arid coastal area of Peru and northern Chile. The collections of Noble and explorations now in progress by Watkins for the American Museum indicate the important discovery that the characteristic bird-life of this fauna has been derived from the valley of the Maranon with which it has been faunally connected at a very recent period. The bird-life of the entire western, or Pacific portion of the tropical zone, is believed to be, geographically, of post-Andean origin. The subtropical zone, or zone of mountain rain-forest, lies between the altitudes of 4,000 to 5,000 and 8,000 to 9,000 feet on the eastern slope of the Andes, but on the southwestern slope the lower temperature produced by the Humboldt current brings the inferior limits of this zone locally down to 1,200 feet above the sea. The temperate zone has well-defined humid and arid divisions. The former includes the upper forested areas on both slopes of the Andes. The latter is contained in the treeless interandine tableland. Like the subtropical it reaches a lower altitude in southwestern Ecuador than in other parts of the republic, and in western Peru it actually falls to sea-level. The fourth, or paramo zone, lies between the upper limits of the temperate zone and the lower limits of snow. On the outer slopes of the Andes the trees of the upper margin of the humid temperate zone border the treeless slopes of the lower limits of the paramo zone. The bird-life of the former includes ar-

[7] Shiro Tashiro, "A chemical sign of life," 1917.

boreal species presumably derived from tree-haunting, tropical ancestors. That of the latter is composed of terrestrial species, most of which have apparently come from the plains of the south temperate zone. The birds of tropical ancestry are, however, much more widely differentiated than those which originated in the south temperate zone, indicating that the degree of differentiation is related to the extent of environmental change rather than its distance from the place of origin.

Studies of the larger tertiary foraminifera from tropical and subtropical America: T. WAYLAND VAUGHAN. For more than a year I have been principally engaged on an investigation of the tertiary larger foraminifera of America in order to make more secure the basis of certain geologic correlations, to extend the correlation ring in the Caribbean region, and to work out in more detail the morphological features of the species of several genera, especially the genus *Lepidocyclina* and its allies. Some of the results of these investigations will be reported.

Interrelationships of the higher invertebrates: A. H. CLARK (introduced by L. O. HOWARD).

Recent discoveries of ancient man in Europe: ALEŠ HRDLIČKA. Under a grant from the Joseph Henry Fund of the National Academy of Sciences and upon conclusion of his work as chairman of the American delegation to the twentieth International Congress of Americanists at Rio de Janeiro, Dr. Aleš Hrdlička proceeded to Europe to examine the more recent discoveries of skeletal remains of early man and several of the most important sites where these discoveries have been made. In this quest Dr. Hrdlička visited Spain, France, Germany, Moravia and England. The important specimens studied included the jaw of Banolas in Spain; the La Quina site and specimens in southern France; the La Ferrassie skeletons, now beautifully restored, in Paris; the Obercassel finds in Brno; the Ehringsdorf discoveries and site at Weimar and at Ehringsdorf; the Taubach site near a village of that name, with the specimens at Jena; and the principal Predmost skeletons now preserved in the Provincial Museum at Brno, as well as the site of these important discoveries at Predmost (in northern Moravia) itself. In addition to these, thanks to the courtesy of Dr. Smith Woodward, Dr. Hrdlička was enabled to submit to a thorough study the Piltdown remains at the British Museum of Natural History and to see there the originals of the Boskop skull as well as the highly interesting Rhodesian skull and parts of skeleton from South Africa. He was finally once more able to see, at the Royal College of Surgeons, London, the originals of the Galley Hill and Ipswich skeletal remains. The examination of the specimens and the visits to the sites where most of them were discovered produced a deep impression on the one hand of the growing importance as well as complexity of the whole subject, and on the other of the vast amount of the deposits in western and central Europe bearing remains of early man and giving great promise for the future. It was also once more forcibly impressed upon the mind of the observer how much more satisfactory is the handling of the original specimens than of even the best made casts. So far as the scientific results of the trip are concerned, Dr. Hrdlička feels confident that he was able to reach a definite conclusion and position as to the human nature of the Piltdown jaw; and to satisfy himself on the more or less intermediate nature, between Neanderthal and the present type of man, of the Obercassel, the Predmost and some other crania; and to see the admirable restorations of both the La Ferrassie and the very important La Quina discoveries, the latter including the highly interesting and, so far as ancient remains of man are concerned, unique specimen of a skull of a child. Plaster casts of nearly all the important specimens not yet represented in the U. S. National Museum were obtained for the institution.

Heredity of body build: C. B. DAVENPORT. Body build is measured as chest circumference in relation to stature. If data concerning chest circumference are absent and weight is known the closest relation to the relative chest girth index is that obtained in adults by dividing weight by the square of stature. Build varies physiologically from birth to maturity. Relative chest girth is about two thirds stature in the infant, declines to 47 per cent. of stature at 12 or 13 years of age and rises on the average to about 53 per cent. in the third decade of life. Stature becomes more variable from infancy to adolescence and then declines in variability into the third decade of life. An analysis of various types of mating of parents of known build with known grandparents leads to the conclusion that fleshy build usually depends upon two or more gametic factors, although there is a type of heavy build that depends upon only one. In general, it is concluded that build depends on multiple factors and that the factors that make for heavy build are dominant over their absence or those which make for slender build. The evidence for this conclusion rests upon relatively small regression in the offspring of very slender parents, as compared with very fleshy ones,

the relatively greater variability of the offspring of fleshy parents as compared with slender ones and various findings in the first and second filial generations from matings of parents with dissimilar build.

Parasitism and evolution: CHARLES A. KOFOID. The digestive tracts of termites or white ants are crowded with teeming hordes of microscopic parasites belonging to the flagellated protozoans distantly related to those found in the blood of cattle in the tsetse fly disease and to those occurring in the diarrheas of mammals, including man. These parasites occur only in those white ants which eat wood and have the power in association with bacteria to hydrolyse the wood. These parasites live in this fluid, which is viscous. The striking thing about the more than a hundred kinds of parasites found in the termites is the fact that they have undergone an evolutionary development of an order of magnitude which in diversity of structures developed and degree of progress attained outruns a hundred fold that which their free-living ancestry and most of their parasitic relations have attained elsewhere. These parasites live compactly crowded together and are ceaselessly moving and rubbing each other. Their evolutionary development consists in an extraordinary increase in number and structural complexity of the nervous and locomotor organs apparently in response to the specialized parasitic type of life in a viscous medium. The organs most stimulated by this mode of life have evolved to a degree without parallel elsewhere in the group to which they belong. The result is the evolution of a number of orthogenetic series of increasingly complex species along diverse lines in each of which a number of the successive steps are still preserved. These animals seem to lack entirely the power of sexual reproduction and therefore may not utilize the advantages arising from the Mendelian laws of genetics. The parasitic environment, the viscous medium in which they live, and the excessive functioning of certain organs are the tools which nature has used in moulding the evolution of these strangely developed organisms. The fact that the neuromotor system, which is so excessively developed in them, is directly and continuously connected with the nucleus, the carrier of hereditary qualities, is significant in this connection.

The nature of resistance to cereal seedling blight: J. G. DICKSON (introduced by L. T. Jones).

Ancient high-level potholes near the Colorado River: F. L. RANSOME. Black Canyon is a narrow and deep gorge cut by the Colorado through a series of andesitic lavas a few miles south of the point where the river turns from a general westerly course to flow nearly due south to the Gulf of California. At the request of the U. S. Reclamation Service, the canyon was examined late in 1922 with a view to determining its suitability from a geological point of view as the site of a high dam. The topography of the canyon suggests that it was rapidly cut in late geological time. Certain faults, that is, fissures, along which there has been movement of the rock on one side relatively to the rock on the other side, appear in the canyon walls. The character of these faults suggests that no recent movement has taken place along them. It is important that the rocks at a dam site should have practical immobility. Accordingly additional evidence was sought to show that the faults are not now active. This was found in the occurrence of typical water-worn potholes and smooth channels, worn in hard andesite, on the brink of the gorge, about nine hundred feet above the present water surface. These were the work of the Colorado before it cut Black Canyon. Some of the smooth channels were cut across one of the faults exposed in the canyon walls. As the channels have not been dislocated it is evident that there has been no movement on this particular fault during the time occupied by the river in cutting down nine hundred feet. The excellent state of preservation of the potholes corroborates the conclusion drawn from other evidence that the cutting of the gorge was, in a geological sense, a rapid process.

The evidence of recent tectonic movement within an area of the western Pacific: W. H. HOBBS (introduced by H. S. Washington).

Geological overthrust and underdrag: W. M. DAVIS.

The marginal belts of the Coral Seas: W. M. DAVIS.

EVENING SESSION

Address: *Résumé of results obtained by the Crocker eclipse expeditions from Lick Observatory:* DR. W. W. CAMPBELL, Auditorium, U. S. National Museum.

TUESDAY, APRIL 24

MORNING SESSION

Symmetric tensors of the second order whose first covariant derivatives are zero: L. P. EISENHART.

Birational transformations simplifying singularities of algebraic curves: GILBERT AMES BLISS. There is a famous old theorem in the theory of algebraic curves which states that every such curve can be transformed by a birational transformation into one which has no singularities

except double points with distinct tangents. The theorem is not a simple one to demonstrate, and many of the proofs which have been given are incomplete or inaccurate. In a preceding paper, to appear in the *Bulletin* of the American Mathematical Society, the author has commented upon these proofs and has signalized two of them as being especially interesting. One is by Walker, who developed an alteration, suggested by Klein in 1894, of a method originally devised by Bertini for the projective plane. In the second, by Hensel and Landsberg, reasoning proposed by Kronecker in 1881 is extended to apply to curves in the function-theoretic plane. Both of these proofs are lengthy and complicated when all the details are taken into consideration. In the present paper the author has remodeled the method of Kronecker so that it can be applied to both planes, and has attained what he hopes will be regarded as simpler proofs of the two theorems.

On the approximate solution in integers of a set of equations of the first degree. Second paper: H. F. BLICHFELDT. To the theorem read by the author at the meeting of the academy on April 26, 1921, is now added the following: Let $F_1, F_2, \ldots, F_{n-1}$ represent $n - 1$ linear and homogeneous expressions in n unknowns $x_1, x_2, \ldots, x_n$, of such a nature that no set of numbers $c_1, c_2, \ldots$ (not all $= 0$) exist for which $c_1F_1 + \ldots + c_{n-1}F_{n-1}$ would be rational in all the coefficients of $x_1, x_2, \ldots, x_n$; furthermore, let there be given a set of n numbers $b_1, b_2, \ldots, b_{n-1}, \varepsilon$. Then integers exist which, when substituted for the unknowns $x_1, \ldots$, will solve the equations $F_1 = b_1 \ldots, F_{n-1} = b_{n-1}$ approximately, the errors being all less than ε in absolute value. Moreover, the product of the errors is less than N/R, where N is a certain number depending only upon the coefficients in $F_1, \ldots, F_{n-1}$ and $R = \sqrt{(x_1^2 + x_2^2 + \ldots + x_n^2)}$.

Properties of path curves in the Einstein theory: E. KASNER. If a family of curves is given at random it will not usually be possible to obtain a Weyl geometry (or more specially an Einstein geometry) in which the curves are the paths of natural motion. A necessary (and for the Weyl geometry a sufficient) purely geometric condition is obtained in Professor Kasner's paper. If the curves are represented in any way in euclidean space the orthogenal projections of the curves touching a given plane at a given point have their centers of curvature on a cubic curve of special type (the given point is a conjugate point with the minimal lines as tangents).

The synthesis of new cinchophen (atophan) types: M. T. BOGERT.

The synthesis of new rose alcohols of geraniol type: E. M. SLOCUM and M. T. BOGERT.

Researches in the thiazole field: M. T. BOGERT.

The exchange of oxygen and carbonic acid between blood and air (illustrated): L. J. HENDERSON.

The relative physiological action of various kinds of protein: D. L. RAPPORT (introduced by Graham Lusk).

The components of amplified nerve action currents demonstrated by means of the cathode ray oscillograph: JOSEPH ERLANGER and H. S. GASSER. Action currents of mixed nerves recorded by this method are shown to be compounded of two or more waves of potential originating simultaneously at the site of stimulation, but propagated at different rates.

Recent problems in radiation: R. W. WOOD.

The limit of accuracy in optical measurement: A. A. MICHELSON.

Tracks of alpha particles: W. D. HARKINS.

Isotopes and atomic stability: W. D. HARKINS.

AFTERNOON SESSION

A study of motions in double stars: H. N. RUSSELL.

Irregularities in spectroscopic binary orbital curves: H. D. CURTIS.

The trigonometric parallaxes of 350 stars determined by photography with the 26-inch McCormick refractor: S. A. MITCHELL (introduced by C. G. Abbot).

Some results of the Yale photographic meteor campaign: C. P. OLIVIER (introduced by Frank Schlesinger).

Pressures at the sun's surface: H. N. RUSSELL and J. Q. STEWART.

The solar prelude of an unusual winter: C. G. ABBOT and colleagues. Does the sun's variation influence the weather? If so, the year 1922 and following months ought to show it. The general mean of "solar constant" values determined by my colleagues and myself at the two Smithsonian Institution solar observing stations, Mount Harqua Hala, Arizona, and Mount Montezuma, Chile, are given below. These observations cover all months from October, 1920, to September, 1922. The extraordinary drop of solar values during 1922 at once is apparent. It is confirmed at both stations. The general mean of solar constant values, in calories, was: October, 1920, 1.943; November, 1.949; December, 1.955; January, 1921, 1.958; February, 1.951; March, 1.946; April, 1.947; May, 1.949; June, 1.934; July, 1.945; August, 1.936; September, 1.944; October, 1.947; November, 1.954; December, 1.951; January, 1922, 1.945; February, 1.946; March, 1.934;

April, 1.927; May, 1.927; June, 1.917; July, 1.911; August, 1.917; September, 1.907. A tabulation of the mean monthly values for the past four years, as determined at Calama alone to July, 1920, and thereafter at Montezuma and Harqua Hala, would show prevailingly high solar constant values until 1922, usually exceeding the normal solar constant value of about 1.94 calories as we have determined it. The figures show that nothing so outstanding as the change of 1922 to low values has occurred in all that interval. Indeed, nothing so marked has occurred since we began these observations in 1905, so far as our Mount Wilson work can show. That work, however, was fragmentary. Low solar radiation values continued to prevail in later months of 1922 and early months of 1923, as results yet unpublished will show. A full account of the individual values here summarized may be found in Volume IV of the Annals of the Astrophysical Observatory of the Smithsonian Institution, supplemented by a forthcoming detailed publication to appear as a supplement of the U. S. Weather Bureau's *Monthly Weather Review*. All this being so, has anything unusual occurred in weather conditions which may have been connected with solar changes? We are not to look for anything so simple as a general drop of temperatures all over the world. Oceans, deserts, mountains, clouds and winds make up too complex a system for such simple reactions. Profound departures of some sort from normal conditions, however, we might expect. It will be recalled that the prevailing characteristic of the weather of the United States for the last couple of years or more is a condition generally warmer than normal. Thus from the summary for 1921, U. S. Weather Bureau, Climatological Data: "The outstanding feature of the year was the unusually warm weather in nearly every month. The annual mean temperature was 66.3 degrees, or 2.7 degrees above the normal, making it the warmest year since the beginning of the state-wide records." The monthly reports for 1922, while less pronounced in this sense, indicate warmer than normal conditions on the whole. We start, then, with an excess of heat. Quoting now from "Climatological Data": "The record of December, 1922, shows unusual contrasts as to the temperature and precipitation in different parts of the country. In the southeast it was the warmest or almost the warmest December for thirty years or more, while in the far northwest it was the coldest December in a like period. The precipitation over Tennessee, Mississippi and considerable parts of the states adjoining was about as great as ever yet recorded there in December, while an area centering in Kansas had no precipitation or practically none."

Note on the visible radiation from germanium oxide and on its melting point: E. L. NICHOLS. In the experiments to be described the oxide, mounted on an alundum block, was treated in an oxy-hydrogen flame. The brightness of three regions of the spectrum—red, green and blue—was measured at intervals of about fifty degrees throughout the range from a red heat to the point of fusion. Germanium oxide does not have the remarkable property first noted by Ch. Fery in certain other oxides, and recently studied in some detail by Dr. Howes, the present writer, of radiating selectively at certain temperatures with intensities greatly in excess of the corresponding "black body" brightness. Its departures from normal radiation are, however, very striking. At the lowest stages of incandescence the red is almost absent (at 700 degrees C. less than one per cent. of black body brightness), whereas the blue nearly equals the blue in the spectrum of a "black body" of that temperature. At 1,200 degrees C. the reverse is true, *i. e.*, the blue of the spectrum is less than one per cent. of "black body" brightness and the red equals the corresponding intensity of the "black body." The oxide is therefore *blue* at the "red heat" and *ruddy* when "white hot." At an intermediate temperature of about 1,050 degrees the radiation is non-selective—having the distribution of a black body spectrum and an intensity of about forty per cent. At 1,400 degrees C. the beginnings of fusion became apparent in the field of the optical pyrometer and until more precise measurements are available that temperature may be taken as the approximate *melting point* of *germanium oxide.*

Electric conduction: E. B. WILSON. According to the free electron theory of electrical conduction the conductivity is proportional to the number of free electrons per cubic centimeter. According to a theory recently developed in a series of papers presented to the National Academy and published in their proceedings, Dr. E. H. Hall has proposed to take into account not only the free electrons but the residual charged atoms from which the electrons have departed. He finds that the major part of the conductivity appears to be due to the behavior of these residual positively charged atoms instead of to the free electrons. On the free electron theory it is reasonable to suppose that a negatively charged conductor might be very slightly more conducting than in the neutral state. On Hall's theory it is reasonable to suppose that a negatively charged conductor should be slightly less conducting than in